

(I) bringing said metal substrate into contact with an aqueous electrolyte solution comprising water and:

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- (A) at least 20 g/l of dissolved zinc cations;
 - (B) at least 20 g/l of dissolved phosphate anions; and
 - (C) at least one dissolved auxiliary acid other than phosphoric acid, said auxiliary acid having at least a first ionization constant that is greater than the third ionization constant for phosphoric acid; and, optionally, other constituents as detailed further below,

this aqueous electrolyte also being in contact with a counter-electrode that is not said metal substrate to be cold worked, so that an electric current can pass through the counter-electrode as anode, the aqueous electrolyte solution by ionic conduction, and said metal substrate as cathode;

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- (II) passing through said metal substrate while it remains in contact with said aqueous electrolyte solution an electric current that has a net cathodizing character at said metal substrate for a sufficient time to form an adherent solid phosphate conversion coating over said metal substrate;
 - (III) discontinuing contact between said aqueous electrolyte solution and said metal substrate bearing said adherent solid phosphate conversion coating; and
 - (IV) applying to the exterior surface of said solid phosphate conversion coating, when it is not in contact with said aqueous electrolyte solution, a water- or oil-based lubricant coating,

the aqueous electrolyte solution having a pH value at least as low as the pH value of a hypothetical reference electrolyte solution that contains the same actual amounts of dissolved zinc and phosphate ions as does said aqueous electrolyte solution and in addition contains at least 30 g/l of nitric acid as its only auxiliary acid;

at least one type of divalent or trivalent metal ions selected from a group consisting of magnesium, aluminum, calcium, manganese, chromium, iron, nickel, and copper; and

a concentration of calcium ions such that the molar ratio of calcium ions to zinc ions is from 0.1:1 to 2:1.

B2 3. (Amended) A process according to claim 1, wherein said aqueous electrolyte solution additionally comprises at least one type of divalent or trivalent metal ions selected from the group consisting of magnesium, aluminum, calcium, manganese, chromium, iron, nickel, and copper.

B3 11. (Amended) A process according to claim 1, wherein before operation (I), said substrate is acid pickled and then rinsed with water.